A Innovative Enhanced Method to Several Face Recognition By Haar Cascades and Eigenface Techniques

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Abstract—Face popularity has continually been challenging problem that holds exceptional attention, it can be considered one of the most a it biometric identity methods amongst several sorts of biometric identity consisting of fingerprints, DNA, palm print, hand geometry, iris recognition. Face popularity affords biometric identification that makes use of the uniqueness of faces for safety purposes. The hassle with face recognition using biometric identification is its lengthy technique and the accuracy of the results. This paper indicates solutions for a faster multiface recognition procedure with accurate effects. The proposed Multiface recognition manner became accomplished the use of a mixture system of Haar Cascades and Eigenface strategies, which can come across a couple of faces in a single detection method.

Keywords- Face recognition; biometric identification; fast face recognition process; Haar Cascades method; Eigenface method.

I. INTRODUCTION

Face recognition has been used as an verification process in various fields and especially in computer security related activities, such as homeland security, building access security, criminal identification. Face recognition also plays a important role in the research field of biometric and computer vision. The goal of a face recognition system is to have a small misclassification rate. Biometric technology is used for authentication and it may examines human behavior. Each biometric system has its own pros and cons, so that proper reflection is required when selecting one to use in an application.

Face detection algorithms are measured to require extreme computation, which creates it is tough to perform face detection. Most of the face reputation procedures are executed on a single face at a time. For a single face to be recognized it can require a short period of time, however for plenty faces using unmarried face reputation, it'll take an awful lot extra time. so, it is critical to expand a system for a couple of faces recognition in one visit speed up the spotting technique. This paper will discuss about a have a look at on a couple of faces reputation the use of a combination approach of Haar Cascades and Eigenface. This examine aspires to develops the overall performance of face popularity system the use of the Haar Cascades and Eigenface approach.

OpenCV may be applied as a face detector type that works with the Haar-cascade classifier. From an photo, a face detector will test every a part of the picture and classify it as "face" or "not face". This facial classification makes use of a fixed scale, as an instance 50×50 pixel. If the face of the photo is larger or smaller than the fixed scale, the classifier continuously processes

the image, looking for a face. The classifier can employ information saved in an XML record to choose a way to classify each image location.

The next a part of this paper presents preceding works which are connected to stand popularity, especially ones that can pick out multiple faces. Its miles then tracked by means of the methodology carried out within the examine supplied in this paper. Later, the outcomes of the experiments performed are reachable and discussed in section IV. Then, the belief of this have a look at may be hooked up in section V.

II. RELATED WORK

Face recognition is one of the greatest rising research regions and it has been used in many domain names. in the subject of education, it is uncovered to have the ability to detect, examines and process emotions with the intention to get positive teaching effects including belief, know-how and expressing feelings [1]. This method includes 3 tiers: function extraction, subset characteristic and emotion classifier. A Haar Cascades method is applied to come across the enter photo, a face, as the basis for the characteristic extraction of the eyes and mouth, after which the Sobel facet detection is carried out to get the function value [1].

There are two fundamental strategies for characteristic extraction, obviously holistic characteristic and nearby feature. inside the holistic characteristic-based totally approach, the capabilities are extracted from the face as a whole, which may additionally every now and then be exaggerated by means of occlusion and expression changes. While in nearby functions- based totally tactics, these are overcome as patches of the photograph are measured. Additionally, they may be scale and rotation invariant [2]. This study utilizes the holistic feature approach using eigenface.

Facial popularity makes use of more than one object detection the use of the Viola-Jones cascade classifier in the OpenCV library [3]. A frontal face is right for face recognition accuracy. Non-frontal facial snap shots can be reformed to frontal face photographs to elevate the accuracy of the facial reputation [4]. Another manner to growth the accuracy of the face reputation can be through filtering techniques [5]. As nicely the similarity size can be used in face reputation through consuming the probabilistic histograms of the maximum chance way [6]. Strong face detection primarily based on Viola Jones face detection algorithm [7, 8, 9] can also be placed into practiced the use of a pix processing unit (GPU) [7, 8, 10].

The implementation version of this have a look at is to help the security manage. This method has also been

implemented by detecting face as in [1, 7, 8, 9]. This look at also finished multiple face detection obligations which include in [9,10] the use of ordered snap shots.

In video-primarily based face reputation systems, the illumination and pose variant troubles are predominant. Maximum of the efficient face reputation systems are extended for managed or indoor environments, subsequently some fail to offer accurate reputation in outside environments with versions in illumination [2,8]. A video-based totally face recognition system primarily based on the Viola Jones face detection algorithm is a crucial building block in lots of applications, together with video surveillance and tracking [7, 8, 9].

METHODOLOGY

The face popularity procedure for multi-faces that is proposed in this look at is represented in parent 1. This face recognition method is going to be carried out within the registration of computer-based totally checks. The manner flow of the facial popularity at some point of registration is shown in determine 2.
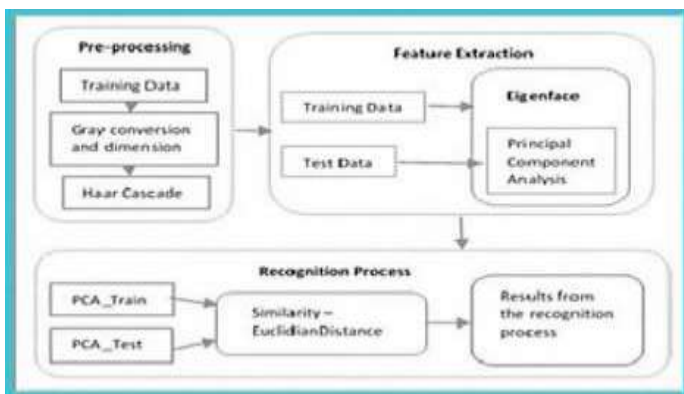

Figure 1. The proposed face recognition process

The proposed process is in progress with pre-processing of the training data by exchanging the RGB images to gray-scale images and decreasing the images to 8-bits color. Then appling the Haar Cascade method to the images by going through the Haar feature phase, integral image and cascade classifier.

The function extraction procedure contains vital functions for the face reputation are extracted from the pre-processed images. The Eigenface technique is shared with PCA to execute the function extraction technique for the schooling information. The take a look at data may be at once practiced the usage of PCA for his or her feature extraction.

The feature extraction process is the recognition process, wherein the PCA_train and PCA_test facts will go through the suit distance calculation based totally at the Euclidian distance approach. Based totally on the Euclidian distance calculations, the end result for the identified image (read: face) is finished.
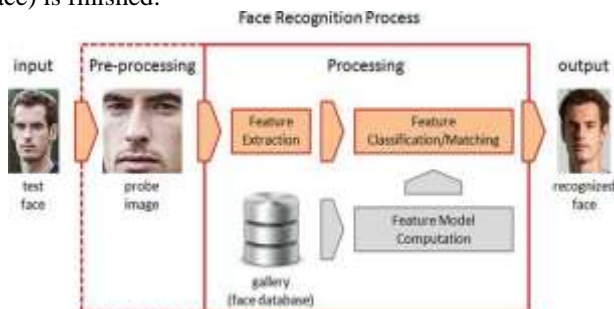

Figure 2. The implementation of the face recognition process

In the execution of the proposed face recognition manner, as shown in discern 2, it begins with taking pictures pictures utilizing a webcam to trap schooling facts, which then is going via the face detection process, characteristic extraction method, after which the core of the face reputation to get the effects. The results are sending to the database. The training information within the database is later applied within the face recognition procedure of the test statistics from the registration at the day of the exam to authenticate the contributors of the examination prior to getting the examination questions in the pc gadget.

All through the face detection method the webcam will pick out the face with the aid of placing boxes to the identified faces as can be visible in parent 3.
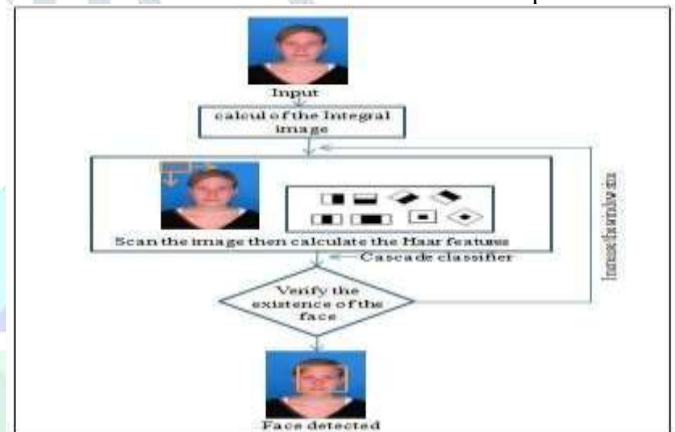

Figure 3. Face detection process on the image

A. Haar Cascade Technique

The approach starts off evolved with the Haar characteristic phase where face detection is achieved via make use of a better differentiator among 'face' and 'now not face'.

In discern four, there are square functions on some parts of the picture in paperwork: black (dark) and white (vibrant). Based totally on those rectangles, the Haar-like feature is considered. The Haar-like feature is obtained from the difference between $F(\text{Haar}) = \sum F_{\text{White}} - \sum F_{\text{Black}}$ the sum of pixels of the darkish place and the sum of pixels of the intense place, as conveyed within the following formulation:

Where:

$\sum F_{\text{Black}}$ = sum of pixels of the dark area

$\sum F_{\text{White}}$ = sum of pixels of the bright area

$= F(\text{Haar})$ the Haar-like feature

When the Haar-like function is higher than a sure threshold, it is able to be said that a face or faces are within the region. To correctly filter a excessive wide variety of faces in the photograph, an critical image technique is used.

Figure 4. An image with Haar-like feature

The Haar feature can be calculated primarily based at the fundamental image. picture. imperative picture is a technique for calculating the feature fee quick by means of changing the fee of every pixel into a brand new photo example. The critical photo fee is the pixel accumulation value of the pinnacle to left calculation. for instance, the pixel cost (a, b) has an accumulative value of pixels (x, y). After integrating, the pixel at (x,y) includes the sum of all pixel values at the shaded rectangle. The pixel values in rectangle D is ((x4,y4) + (x1,y1))
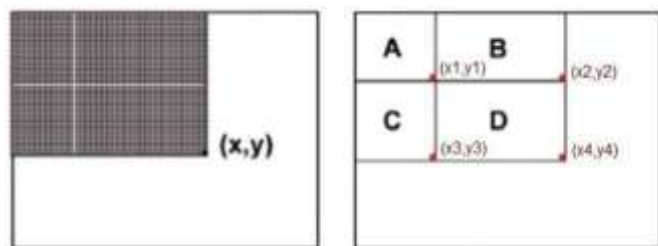

– ((x3,y3) + (x2,y2).

One instance of counting of Integral Image is as follows:

SUM: (D + A) - (B + C)

The Haar feature price is calculated primarily based on the crucial image value that is defined as the distinguishing price between the field (white and black pixels), that is typically referred to as the threshold value. This threshold is a parameter to decide whether or not the object is a face or now not.

The Cascade Classifier technique joins many weak classifiers to show into sharper pictures (sturdy classifiers) by means of transfering weights to the weak classifiers photo. Cascade Classifier circuitously this will be called as a filter out chain. Each filter is a classifier by using a disconnect increase with a exceedingly small wide variety of weak classifiers.

Figure 6. Process flow of Cascade Classifier
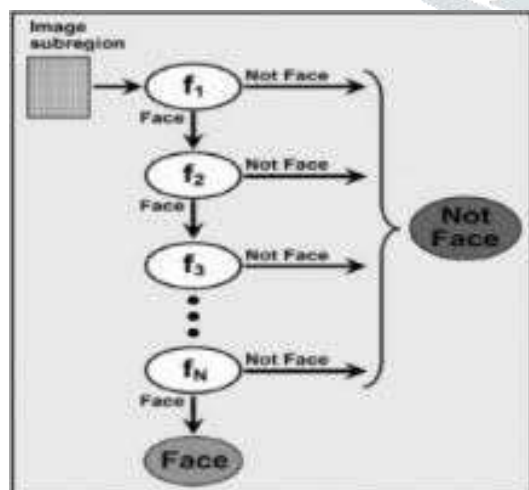
The threshold value for each filter is set on every occasion the filter process happens, so the value of the threshold is dynamic. Filters at every stage had been trained to classify imagery that has passed the preceding level. All through the classification procedure, if one of the filters did not pass, then the image may be stated to be a non-face. If the image isn't always enough, way a robust classifier, then the process is repeated till the weights are met with the aid of elevating the by raising the value of the threshold.

while the image can pass through every filter out within the chain, it approach that the area is the face. To get accurate values, the processing of haar-like functions is done. If at level-1 the consequences do now not meet the requirements, the end result is rejected. Then, the set of rules will circulate to sub subsequent window this is segment-2 and could remember function again, if the end result obtained suits within the threshold, then it'll be continued at the following filter stage in order that the sub window step decreases and moves closer to the actual image value.

The filter out process occurs, so the cost of the threshold is dynamic. Filters at every level have been certified to classify imagery that has exceeded the previous stage. In the course of the type process, if one of the filters failed to bypass, then the photo may be alleged to be a non-face. If the image isn't enough, way a robust classifier, then the process is showing once more till the weights are met by using growing the value of the threshold.

Filters at every stage are certified to classify previously filtered images (education set is a database of faces). Throughout its exercise, if one of the filters fails, that vicinity of the image is classed as "not face". While the filter efficiently exceeds that place, it then enters the following filter. Image regions that have been via all filters can be measured as "Face".

The face detection application is processed like:

1. The face image of the capture result is changed from RGB to Greyscale.

2. Normalization of lighting.

3. Haar Cascade detection.

4. Facial extract with eigenface calculation for face recognition.

5. Face recognition process with PCA calculation

6.

III. RESULT AND DISCUSSION

Experiments within the proposed face recognition process concerning numerous elements were performed to see the presentation of the system developed based totally on the proposed method.

The primary test turned into indicates the location factor of the faces that have been being documented. Statistics in table 1 exhibits the outcomes from this test. The effects show that handiest whilst the face is inside the side going through position for 30 stages, then the face became fail to be recognized.

Position	Degree of the position	Detection results (%)
Normal	0	100
Head up	25	100
Head down	25	100
Side facing 1	15	100
Side facing 2	30	0

Classroom 1	2	2
Classroom 2	3	3
Classroom 3	5	5
Classroom 4	6	6
Open space	60	55

Table 1. Detection results for various face position

The second test taken into consideration the distance thing of the face detection process. Table 2 exhibits the results of this experimentation. The records indicate that face detection can be successfully performed up to 2 hundred cm.

Table 2. Detection results at various distance

D3	120	120
D4	170	170
D5	200	200

the following experiment is to see what number of dissimilar faces may be identified in a single instance in the course of the face popularity procedure. The results are displayed in desk three.

The data in table 3 shows that out of 60 faces that want to be detected, 55 may be correctly recognized. Which means the success price is 91.sixty seven% for the multi-faces reputation process.

Table 3. Results of multi-faces recognition process

Location	Targeted number of faces	Detected number of faces
Distance	Targeted distance	Detection distance
D1	20	20
D2	70	70

Figure 6, shows the comparison of multi-faces recognition process.
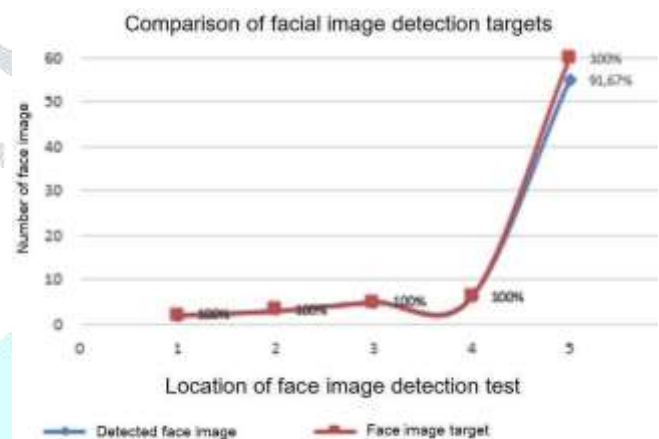

Figure 6. Comparison of multi-faces recognition process

The data in Table 4 shows the following:

1. The facial recognition process is effectively optimized inside the specific target.

2. Whilst the face is grew to become away, the facial image continues to be capable of be recognized, even though the chosen technique is for instantly face detection.

Table 4. Multi-face recognition optimization
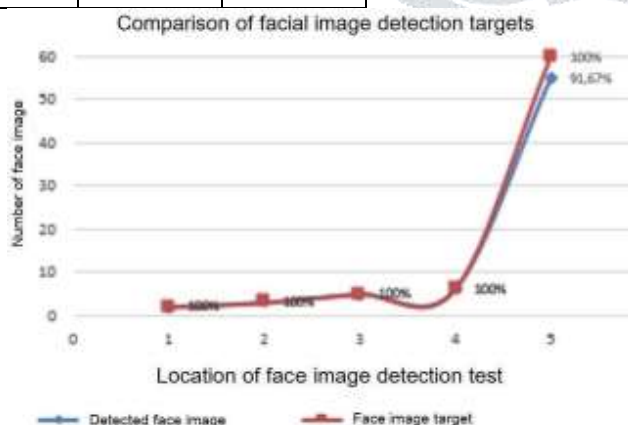
Face Position	Image targets to be recognized	The results of the face image to be recognized
1 facial image (normal)	1	1
2 facial image (optimization)	2	2
3 facialimage (optimization)	3	3

Figure7 shows that during test1,2 and 3,the face of user-1 and the face of user-2 can be recognized. Recognizing the facial image can be executed successfully upto 200cm.
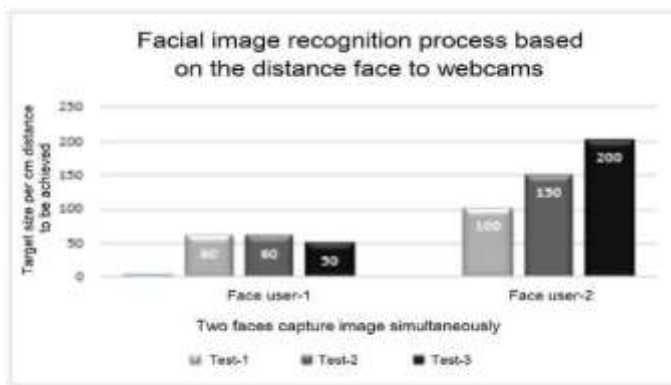
Figure 7. Results of facial image recognition based on distance.

IV. CONCLUSION

The technique of facial recognition with the Haar Cascade and Eigenface technique is capable to discover and identify the face both all through the day and night time (with mild) as displayed within the take a look at effects. despite the fact that the form of detection is for direct faces (the front), it is nonetheless capable of detect the face when it's far going through to the side until about 15o (levels).

The facial recognition procedure with the Haar Cascade and Eigenface approach is capable of optimize facial recognition with a couple of face with accuracy as much as ninety one. 67%.The facial recognition process with the Haar Cascade and Eigenface method can be effectively performed at a distance of more than 200 cm using a webcam.

For future work, while the current development is for straight faces, it can to be improved to recognize faces at different angles.

It is supposed to extend the proposed system with the reason of classifying exclusive facial expressions for next recognition technique

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